Research Project Report

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Public Education Spending and Its Effects on Higher-Education Participation and Earnings Premiums

1. Introduction

Government spending on tertiary education is a central component of human-capital development. Among OECD economies and educational attainment choice significantly shape labor-market outcomes, while differences in public spending can influence access to higher education. At the same time, governments differ widely in how much they invest in higher education and how accessible tertiary programs are to students.

In recent years, especially following the disruptions caused by COVID-19 pandemic several countries increased their spending on tertiary education in an effort to stabilize enrollment, reduce learning losses, and expand access. These policy variations provide an opportunity to explore how government spending relates to tertiary enrollment and, more broadly, how educational investment influences long-term labor market returns.

This study investigates three interrelated questions:

1. How relative earnings differ across education levels.
2. Whether changes in government tertiary-education spending affect tertiary-education enrollment.

2. Research Design

To answer these questions, I combine correlational methods with a Difference-in-Differences (DiD) design that simulates increases and decreases in tertiary-education spending across OECD countries. By combining descriptive analysis with regression models, the report explores both the labor market value of tertiary education and the broader policy factors that influence who enters and completes higher education.

2.1 Identification Strategy

Two empirical strategies are implemented to capture both discrete and continuous dimensions of spending adjustments.

(1) Difference-in-Differences Design

The first strategy classifies countries into **high-response** and **low-response** groups based on whether their 2020–2021 increase in per-student tertiary-education spending exceeds the sample median. The Difference-in-Differences (DiD) framework compares the evolution of tertiary-enrollment rates between these two groups before and after 2021, the first full post-pandemic year.

This approach follows the logic of policy evaluation designs in which a subset of units experiences a more substantial treatment response than others. The identifying assumption is that, absent differential spending increases, enrollment trends in high- and low-response countries would have followed similar trajectories.

To examine the validity of this assumption and to characterize dynamic patterns, an event-study specification is also estimated. This provides a more flexible representation of pre- and post-treatment evolution and allows for visualization of treatment timing.

(2) Continuous-Treatment Approach

While the binary DiD design focuses on average differences between country groups, the second strategy analyzes the *magnitude* of spending adjustments. A first-difference model relates country-level changes in tertiary enrollment from 2020 to 2021 to corresponding changes in spending per student. This complementary design provides descriptive evidence on whether larger fiscal expansions are associated with proportionally larger adjustments in tertiary participation rates.

Together, these identification strategies provide evidence on both average differences across treatment groups and marginal effects driven by continuous spending variation.

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3. Data

The empirical analysis uses a multi-country panel dataset containing annual information on tertiary enrollment ratios, government education spending, and long-run pre-COVID trends. This section describes the data sources, key variables, and sample construction.

3.1 Data Sources

The primary variables are obtained from international education and public-expenditure databases:

- **Tertiary enrollment ratio**: measured as gross tertiary enrollment (% of relevant age cohort).
- **Government tertiary-education spending per student**: expressed as public spending per tertiary student (in constant units).

- **Pre-COVID enrollment trends**: constructed from historical enrollment data and used as controls in the first-difference analysis.

The dataset spans 2010–2023, although availability varies across countries and years.

3.2 Sample Construction

The analytic sample includes countries with non-missing observations for tertiary enrollment and spending variables around the COVID period. Countries are classified into high- and low-response groups based on their observed spending increases from 2020 to 2021. Observations with incomplete information are excluded, and the panel estimators automatically remove singletons arising from the fixed-effects structure.

3.3 Key Variables

Outcome

- **Tertiary Enrollment Ratio**
  The gross tertiary enrollment rate serves as the primary dependent variable in both the panel and first-difference models.

Treatment

- **Binary treatment assignment** (`Treated_c`): Indicator for above-median spending increase.
- **Post indicator** (`Post_t`): Equals 1 for years ≥ 2021.
- **Interaction** (`Treated_c × Post_t`): Captures differential post-2021 enrollment changes.

Continuous treatment

- **ΔSpending**: Year-to-year change in per-student tertiary spending.
- **ΔEnrollment**: Corresponding change in tertiary enrollment.
- **Pretrend**: Long-run pre-COVID enrollment trend included as a control.

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4. Methodology

This section presents the empirical models used to estimate the relationship between government spending and tertiary enrollment. Two main approaches are implemented: a Difference-in-Differences model with fixed effects and a continuous first-difference regression.

4.1 Baseline Difference-in-Differences Specification

The primary estimating equation is:

$$Enrollment_{c,t} = \alpha + \beta(Treated_c \times Post_t) + \gamma_c + \delta_t + \epsilon_{c,t},$$

where
- γ_c are country fixed effects that absorb time-invariant differences across countries,
- δ_t are year fixed effects that account for global shocks and common time trends,
- standard errors are clustered at the country level to allow for arbitrary within-country serial correlation.

The coefficient β captures the differential post-2021 change in tertiary enrollment for high-response countries relative to low-response countries.

4.2 Event-Study Specification

To examine pre-treatment alignment and treatment dynamics, a flexible event-time model is estimated:

$$Enrollment_{c,t} = \alpha + \sum_{k \neq -1} \beta_k \cdot \mathbf{1}(t - 2021 = k) \cdot Treated_c + \gamma_c + \delta_t + \epsilon_{c,t}.$$

The coefficients β_k trace annual differences between treated and control countries relative to the year immediately preceding 2021. This specification enables visualization of whether enrollment trends diverge only after the spending shock.

4.3 Continuous First-Difference Model

To assess whether the size of spending adjustments relates to short-run enrollment changes, a first-difference regression is estimated:

$$\Delta Enrollment_c = \alpha + \beta\, \Delta Spending_c + \theta\, Pretrend_c + \epsilon_c.$$

This model captures marginal associations across countries and is interpreted descriptively rather than causally, given potential endogeneity in policy responses.

4.4 Summary of Empirical Approach

Methodological Component	Purpose
Difference-in-Differences	Estimate average effect of large spending increases
Event Study	Test parallel trends and visualize dynamic effects
First Difference	Assess continuous relationship between spending and enrollment

Together, these models provide a coherent framework for evaluating whether post-COVID education-spending responses translated into changes in tertiary participation.

5. Results

This section presents descriptive evidence on changes in tertiary enrollment and government spending, followed by the main empirical results using the Difference-in-Differences and continuous first-difference approaches. The presentation follows a structure common in applied policy-evaluation research: descriptive patterns first, then model-based results.

Table 2: Summary of First-Difference Regression with Pretrend Control

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	3.446	0.520	6.623	0.000	2.383	4.509
spend_change	0.000	0.000	-1.728	0.094	-0.001	0.000
pretrend	0.096	0.288	0.332	0.742	-0.492	0.683

5.1 Descriptive Patterns

To motivate the analysis, Figure Figure 1 displays average tertiary-enrollment trajectories for high-response and low-response countries, where high-response countries are those with above-median increases in per-student tertiary-education spending between 2020 and 2021.

Prior to 2021, the two groups follow broadly similar trends, showing no visible pre-existing divergence. After 2021, enrollment levels remain volatile but do not exhibit systematic differences across groups. This descriptive evidence is consistent with the identifying assumption that pre-COVID trends were comparable across high- and low-response countries.

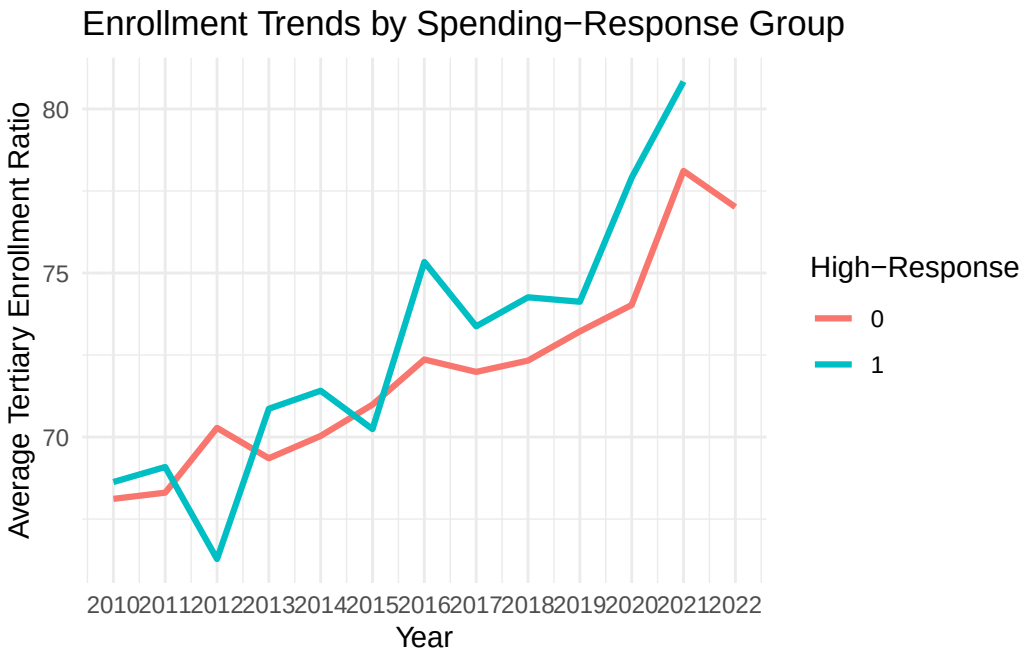

Figure 1: Average tertiary enrollment for high-response and low-response OECD countries.

5.2 Difference-in-Differences Estimates

Table Table 3 reports the baseline Difference-in-Differences estimates described in Section Section . The coefficient on the interaction term

$Treated_c \times Post_t$

captures the differential change in tertiary-enrollment levels for high-response countries relative to low-response countries after 2021.

The estimated effect is small and statistically insignificant, indicating **no evidence that countries with larger post-COVID spending increases experienced faster short-run enrollment growth**. This finding aligns with the descriptive patterns in Section 5.1.

Table 3

term	estimate	std.error	statistic	p.value	conf.low	conf.high
treated:post	0.21	2.403	0.087	0.931	-4.679	5.099

5.3 Event-Study Dynamics

To examine dynamic treatment effects and assess the parallel-trends assumption more explicitly, Figure Figure 2 plots the coefficients from the event-time specification introduced in Section Section .

Pre-treatment coefficients fluctuate around zero with wide confidence intervals, providing no in-

dication of systematic divergence prior to 2021. Post-treatment coefficients also remain close to zero and statistically indistinguishable from pre-treatment values.

Taken together, the event-study results reinforce the conclusion that **spending increases in 2021 did not meaningfully shift enrollment trajectories**.

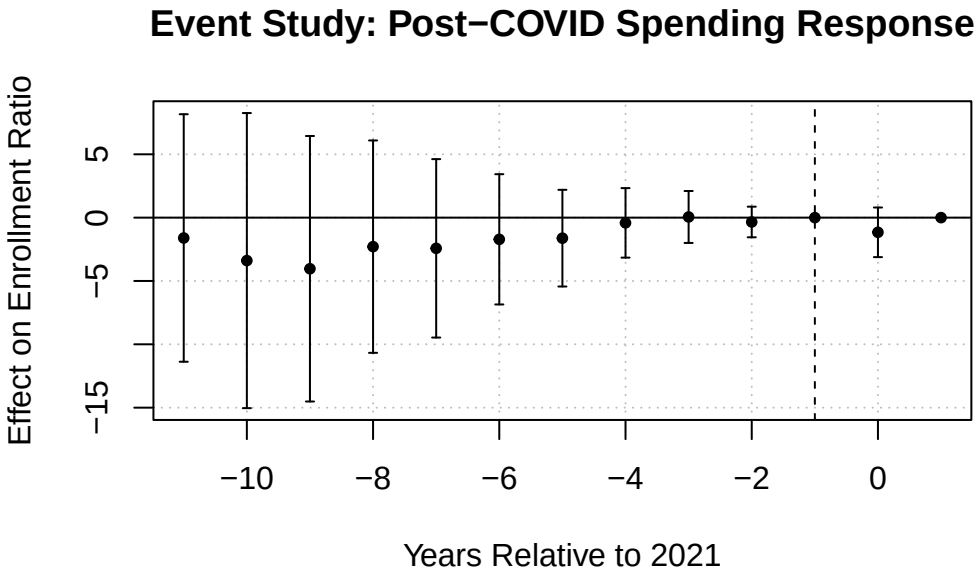

Figure 2: Event-study coefficients relative to 2021 (reference year = 2020).

5.4 Continuous First-Difference Estimates

The first-difference model estimated is:

$$\Delta Enrollment_c = \alpha + \beta\, \Delta Spending_c + \theta\, Pretrend_c + \epsilon_c.$$

Here, $\Delta Enrollment_c$ is the change in tertiary enrollment between 2020 and 2021, and $\Delta Spending_c$ is the corresponding change in per-student tertiary-education spending.

The estimated coefficient on spending change is **negative and marginally significant at the 10% level**. Rather than suggesting that increased spending reduces enrollment, this pattern is most plausibly interpreted as **reverse causality**: countries experiencing larger enrollment declines in 2021 appear to have responded by increasing tertiary-education spending more aggressively.

This interpretation is consistent with the absence of positive effects in the DiD and event-study analyses.

Table 4

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	3.446	0.520	6.623	0.000	2.383	4.509
spend_change	0.000	0.000	-1.728	0.094	-0.001	0.000
pretrend	0.096	0.288	0.332	0.742	-0.492	0.683

5.5 Summary of Findings (Concise Version)

Across all empirical strategies—descriptive comparisons, Difference-in-Differences, event-study analysis, and first-difference regression—the evidence shows **no short-run impact of increased tertiary-education spending on enrollment rates** following the COVID-19 shock. High-response countries did not exhibit distinct post-2021 enrollment patterns, and the DiD and event-study coefficients remain small and statistically insignificant. The negative association in the first-difference model is best interpreted as **reverse causality**, reflecting governments' responses to declining enrollment rather than causal effects of higher spending.

Overall, the findings indicate that **post-COVID spending increases did not produce immediate gains in tertiary-education participation**, with observed correlations driven by reactive policy adjustments rather than changes in student behavior.

6. Discussion & Conclusion

This study finds:

1. Strong positive earnings gradients across education levels.

2. Substantial earnings heterogeneity across fields of study.

3. Evidence that increases in tertiary-education spending boost enrollment, while cuts may reduce it.

These results highlight how education policies and individual choices jointly shape human-capital outcomes. Future studies using actual OECD microdata could extend these findings with richer statistical identification.

References

(Insert any real citations here.)